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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/542,616	07/18/2005	Teodor Aastrup	066935-076983	7334

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EXAMINER	
FITZGERALD, JOHN P	
ART UNIT	PAPER NUMBER
2856	

MAIL DATE	DELIVERY MODE
10/28/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/542,616	AASTRUP ET AL.	
	Examiner	Art Unit	
	JOHN FITZGERALD	2856	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 August 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13 and 23-28* is/are pending in the application.

4a) Of the above claim(s) *6,7 and 11-13* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 July 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 12 August 2008 have been fully considered but they are not persuasive. The Examiner will address Applicant's arguments more or less in order as presented in the response filed.

2. Applicant has amended claims 1-4, 25-26 by adding the limitation "continuous" before "surface area" regarding the first electrode and argues that this limitation has overcome Prior Art of record, in particular, the Thompson et al. reference, since the Thompson et al. reference clearly teaches that portions of the electrode can be removed (diameters, i.e. circular areas) to alter/modify/reduce the total electrode surface area. Furthermore, it appears that the "continuous" limitation was only added to overcome the Thompson et al. reference, and that this limitation is not critical to the instant invention. The Examiner respectfully disagrees that this newly added limitation of "continuous" fails to overcome the Prior Art of record. Applicant argues, incorrectly, that the instant specification, in each instance, describes the first electrode as a "continuous" surface area. This is, in fact, completely false. The newly recited limitation of "continuous" does not appear at all in the instant specification in regards to the surface area of the first electrode. Simply because the instant specification does not refer to surface areas being a "doughnut shape" or having an "interior hole" does not preclude an electrode from having that shape or characteristic. While technically no new matter has been entered regarding the newly added limitation of "continuous," since the instant Figures appear to indicate this newly recited limitation, the instant Figures are a general illustration of the instant invention, and do not preclude an electrode from having any particular configuration, having holes or otherwise.

Furthermore, the instant specification fails to disclose that the newly added limitation of the first electrode having "continuous" surface area is critical to the instant invention, or solves a particular stated problem, or serves a particular purpose, and as such, it appears from the Applicant's own specification that any type of electrode having a total flat surface area will function equally as well. The Thompson et al. reference clearly discloses that portions of the electrode area are to be removed, thus altering the total surface area to alter/enhance the sensitivity of the TSM device (paragraphs 0044 and 0046). In any event, Thompson et al. further state that the portions of area removed can be located anywhere on the disc area surface of the electrode, and thus, if a portion is taken at the very edge of the circular diameter electrode, the result would meet the general definition of "continuous" surface area, for then the overall surface of the electrode would be uninterrupted. Lastly, since the Applicant has failed to fully define the term/limitation "continuous" in the instant specification regarding the surface area of the electrode, an broad interpretation of the newly added limitation can be construed as any portion of the electrode area having "continuity" or, perhaps, a continuous, uninterrupted line can be drawn (i.e. a diameter) from one point along the circumference to another opposite point, or a continuous, uninterrupted circle can be drawn on the electrode surface.

3. Applicant argues that the Examiner has not met prima facie case for obviousness repeatedly, however, this does not make it so. Simply because the Applicant disagrees with the Examiner's scientific reasoning, it does not negate the Examiner's argument. In fact, the Applicant simply glosses over the Examiner's scientific reasoned rejection, incorrectly claiming that it is taken out of context and that the arguments are tangential. In fact, the Applicant has completely disregarded the Examiner's arguments and scientific reasoning for one of ordinary

skill in the art to modify the electrode area based on the Sauerbrey equation (as also stated in the Thompson et al. reference), since it directly relates to the change in frequency response of the TSM device to a change in mass and area of the electrode(s). Simply because the Applicant ignores the Sauerbrey equation and the scientific reasoning behind it, does not negate its application to the instant invention, which is to provide a prima facie case of obviousness motivating one of ordinary skill in the art to modify the surface area/size of the electrode(s). Applicant has failed to refute any of the Examiner's arguments, only simply repeating that the Examiner has failed to make a prima facie case of obviousness over and over, which the Examiner has clearly done, by providing sound scientific reasoning and teachings from the Prior Art references. The facts are simple. Thompson et al. clearly disclose that the surface area of the electrode is altered/modified/reduced by removing portions thereof, to change the response characteristics, thus providing a clear motivation and teaching to one of ordinary skill in the art at the time the invention was made to alter the total surface area of the electrode. Applicant attempts to make the argument that the Thompson et al. reference teaches away from the claimed invention, which is clearly false, by taking a single sentence, completely out of context, from the Thompson et al. reference. The full statement reads: ***"For the modified electrode case, the noise level is greater and the resolution of the curve is lower compared to that originating from the unmodified electrode. This is understandable since reducing the electrode size of one of the electrodes causes instability in device resonance. Clearly, a tradeoff between stability and sensitivity of the device is involved in optimization of any future design." (paragraph 00500).*** So, in fact, the Thompson et al. reference does not teach away from the instant invention at all. Thompson et al. clearly state there is a tradeoff in stability and sensitivity when

modifying the size (i.e. total surface area) and shape of the electrode, which does not negate one of ordinary skill in the art to indeed modify the electrode's size/area and shape. In fact, it only supports the Examiner's argument that one of ordinary skill in the art is well aware that modifying the surface area of the electrode is well within his/her skill set.

4. Applicant argues that the Examiner has not met prima facie case for obviousness in employing the Josse et al. reference. The Examiner respectfully disagrees. Applicant states that Examiner admits that Josse et al. fail to disclose "a continuous surface area". This is completely false. How can the Examiner admit that a limitation does not exist (i.e. the limitation "continuous") if the limitation was not present in the claim when the previous rejection was made by the Examiner? This limitation is clearly addressed in the current rejection, as well as above, since, clearly, Josse et al. disclose electrode(s) having "continuous surface area." Applicant is incorrect in stating that the Examiner did not address the Aastrup declaration. The Examiner clearly stated in the previous office action: "The Aastrup declaration does not alter the basic facts and evidence presented by the Examiner. Those facts being that one of ordinary skill in the art is well aware that alterations in the geometry of the electrode will lead to alterations in the frequency response of the TSM device." It is not surprising that the inventor (Aastrup) of the instant invention attempts to declare that his invention is non-obvious over the Prior Art. However, without the Examiner conceding the point that decreasing the surface area of the electrode inherently reduces its sensitivity, and assuming that the Applicant and the Aastrup declaration are correct, that the reduction of surface area increases the sensitivity of the TSM device, one of ordinary skill in the art, could, in fact, employ this motivation to reduce the size of the electrode to below $15mm^2$, or any other smaller area, if less sensitivity is required in the

application of the TSM device, for example, in an environment where there is a heavy concentration of the analyte to be detected/sensed. Thus, if a low sensitivity is an actual requirement (or desired) of the application of the TSM device by one of ordinary skill in the art, he/she would be motivated to reduce the size/area of the electrode, thus providing a prima facie case of obviousness to alter/modify, in this case, reduce, the total surface area of the electrode. Instant independent claim 1 (nor its dependents) recite any limitations regarding "sensitivity" or "functionality" of the claimed TSM, only reciting specific structural limitations, and as such, the Josse et al. reference in combination with the ordinary knowledge and skill set of one in the art, would clearly be motivated to alter the size/area of the electrode to sense a desired concentration of analyte.

5. The Applicant continues to argue that the Examiner has made unsupported statements regarding the size/area of the electrode, however, the Applicant continues to misread and/or misunderstand the Examiner's statements. The Applicant quotes the Examiner's statement, being: "It is well known in the art that variations of the electrode structure (i.e. total mass and area) can increase the sensitivity of the resonator, the ability to sense a variety of analytes of interest and the ability to determine the concentration of one or more materials of interest." This statement is factual and completely correct, and the Applicant has failed to provide a convincing argument otherwise. The Applicant continues to incorrectly argue that since the Examiner has not found any specific disclosure regarding an electrode having a surface area less than $15mm^2$, (i.e. specific dimensional values recited in a Prior Art reference, Josse et al. or otherwise) and because of that, he has not proved a prima facie case of obviousness. Clearly, the Examiner is not required to find the specific dimensional values recited in the claims, but only required to

provide a reasonable motivation for one of ordinary skill in the art at the time the invention was made to modify the Prior Art reference, which is to alter the total area of the electrode surface. The Examiner's burden is only to provide a reasonable motivation for a combination of two or more prior art references, or the modification of a single prior art reference. Simply because Applicant makes the argument that "surprising and unexpected results" were obtained does not, in fact, make it so. The reason or motivation to modify a reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem (In the instant case, to modify the electrode area based on the teachings of Josse et al. and the knowledge of one having ordinary skill in the art). It is not necessary that the prior art suggest the combination and/or modification to achieve the same advantage or result discovered by the applicant, in this case, the so-called "surprising and unexpected results" of employing a TSM device having an electrode having the specific geometry as claimed. See, e.g., In re Kahn, 441 F.3d 977, 987, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006) (motivation question arises in the context of the general problem confronting the inventor rather than the specific problem solved by the invention); Cross Med. Prods., Inc. v. Medtronic Sofamor Danek, Inc., 424 F.3d 1293, 1323, 76 USPQ2d 1662, 1685 (Fed. Cir. 2005) ("One of ordinary skill in the art need not see the identical problem addressed in a prior art reference to be motivated to apply its teachings."); In re Linter, 458 F.2d 1013, 173 USPQ 560 (CCPA 1972) (discussed below); In re Dillon, 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), cert. denied, 500 U.S. 904 (1991)

6. The examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the

knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, one of ordinary skill in the art is well aware of the basic underlying physics of the operation of TSM devices, as illustrated by the Sauerbrey equation, as well as the basic physical facts that electrodes having different total areas will respond differently based on that total area, since the total mass that is vibrating is different, thus leading to different frequency responses. Once again, simply because the Applicant claims that a smaller electrode area leads to a more sensitive TSM resonator, does not, in fact, make it so. As pointed out above, even if the Applicant is correct in stating that the claimed TSM resonator has increased sensitivity (which the Examiner does not concede) one of ordinary skill in the art at the time the invention was made would modify the size/area of the electrode, in particular, reduce the overall surface area of the electrode, one of ordinary skill in the art, could, in fact, employ this motivation to reduce the size of the electrode to below $15mm^2$, or any other smaller area, if less sensitivity is required in the application of the TSM device, for example, in an environment where there is a heavy/high concentration of the analyte to be detected/sensed. Thus, if a low sensitivity is an actual requirement (or desired) of the application of the TSM device by one of ordinary skill in the art, he/she would be motivated to reduce the size/area of the electrode, thus providing a prima facie case of obviousness to alter/modify, in this case, reduce, the total surface area of the electrode. Instant independent claim 1 (nor its dependents) recite any limitations regarding "sensitivity" or "functionality" of the claimed TSM, only reciting specific structural limitations, and as such, the Josse et al. reference in combination with the ordinary knowledge and skill set

of one in the art, would clearly be motivated to alter the size/area of the electrode to sense a desired concentration of analyte.

7. The Applicant dismisses the Examiner's employment of the recent KSR decision, which is clearly applicable in the instant case. Simply because that a single prior art reference was employed, coupled with the knowledge of one having ordinary skill in the art, does not render the KSR decision statements inapplicable. The KSR court has recognized that "[w]hen there is a design need or market pressure to solve a problem (i.e. a particular frequency response of the TSM device) there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options (in this case alterations of the area of the electrodes to obtain different response characteristics) within his or her technical grasp." KSR 127 S. Ct. at 1742. In such circumstances, "the fact that a combination was obvious to try might show that it is obvious under 103." Id. Clearly, one of ordinary skill in the art at the time the invention was made is well aware employing the basic physics of the problem (as well as the Sauerbrey eqn.) to modify the TSM resonator disclosed by Josse et al., most notably, the total area of the electrode(s) to obtain different desired response characteristics. Applicant's citation of the Federal Circuit decision (Eisai Co. Ltd. v. Dr. Reddy's Laboratories, Ltd, and Teva Pharmaceuticals USA, inc. Fed. Cir. 2007-1397,-1398, decided July 2008) appears to apply to chemical compounds, and not to physical devices as claimed. The motivation to modify, i.e. the "finite predictable solutions" applied in the chemical arts is vastly different that the possible/predictable solutions in the measurement and testing art. In any event, the Examiner has provided that there are indeed "finite predictable solutions" regarding the changes in the total surface area of the electrode, based on the Sauerbrey equation and teaching in the Prior Art.

8. Furthermore, the rationale to support a rejection under 103 may rely on logic and sound scientific principle. *In re Soli*, 317 F.2d 941, 137 USPQ 797 (CCPA 1963). However, when an examiner relies on a scientific theory, evidentiary support for the existence of that theory must be provided, as the Examiner has done. *In re Grose*, 692 F.2d 1161, 201 USPQ 57 (CCPA 1979). The rationale to modify or combine the prior art does not have to be expressly stated in the prior art; the rationale may be expressly or impliedly contained in the prior art or it may be reasoned from knowledge generally available to one of ordinary skill in the art, established scientific principles, or legal precedent established by prior case law. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 159 6 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). See also *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) (setting forth test for implicit teachings); *In re Eli Lilly & Co.*, 902 F.2d reliance on legal precedent); *In re Nilssen*, 851 F.2d 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988) (references do not have to explicitly suggest combining teachings); *Ex parte Clapp*, 227 USPQ 972 (Bd. Pat. App. & Int. 1985) (examiner must present convincing line of reasoning supporting the rejection); and *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Int. 1993) (reliance on logic and sound scientific reasoning). In the instant case, the Examiner has provided an excellent and convincing line of reasoning supporting the rejection based on the coupling of knowledge of one having ordinary skill in the art to modify the Josse et al. reference.

Claim Rejections - 35 USC § 103

9. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

10. Claims 1-5, 8-10 and 25-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 2003/0076743 A1 to Thompson et al. Thompson et al. disclose a thickness shear mode (TSM) piezoelectric resonator for use in a sensor arrangement for detecting or measuring an analyte in a medium, i.e. in a method of sensing and measuring using the TSM, as recited in claim 23), employed to measure both gas and liquid samples (as recited in claim 24) by mass changes, including a quartz crystal plate (see Fig. 4 below) having two flat (as recited in claim 10) crystal surfaces (first and second) wherein the first crystal surface has a first electrode having an edge and a second crystal surface having a second electrode (as recited in claim 1), and wherein the first crystal surface has a first contacting area connected to the first electrode, as well as the second crystal surface and the second electrode (as recited in claims 8 and 9); wherein the area of the first electrode is smaller than the first crystal surface area and where the first electrode has a surface area that is 0.1-90% of the crystal area (see Fig. 4 below) (as recited in claims 3 and 26). Thompson et al. does not specifically disclose quantitative measures of the electrodes, i.e. the first crystal surface having a first electrode having a continuous surface area of less than 15mm^2, 10 mm^2 or 1-5 mm, or at least 0.05 mm^2 (as recited in claims 1, 2, 3, 25), or specific measures of distances between the crystal plate edge and of the electrode being 0.2 mm, 1mm or 2mm) (as recited in claims 5, 27 and 28). However, Thompson et al. do disclose teachings in regards to the variation and modification of geometry of the electrode(s), in particular, their total surface area, as well as perimeter edge distances between the electrode and

crystal edge (see paragraphs 0021, 0030, 0031, 0043-0046). In particular, Thompson et al. disclose that to investigate the effect of modification of the electrode geometry (i.e. total surface area and edge effects) on the sensitivity of the TSM device, disks of 1.5 mm diameter (thus equating to the removal of area of 1.77 mm^2) were removed from different locations of the electrode (see paragraph 0043). Thompson et al. further disclose that the two electrodes can have different total areas, i.e. one electrode having a larger surface area than the other that is mounted on the opposite side of the crystal plate (see paragraph 0014-0015) as well as a functional relationship regarding the frequency response based on the difference of those areas (see equation 5). Thompson et al. further teach that removal (or etching) of the electrode(s) (i.e. removal of mass from the electrode) by etching radial lines will effect the response of the TSM device, based on the Sauerbrey equation ($\Delta f = -2\Delta m f^2 / A(\mu\rho)^{1/2}$ where: the change in frequency is proportional to a change in mass and area of the electrode) (paragraph 0048). It would have been obvious to one having ordinary skill in the art at the time the invention was made to alter the geometry of the electrode(s), including, but not limited to, varying the total surface area of the electrode(s) and/or modifying the electrode edge perimeter and/or distance from the electrode to the quartz plate edge, thus meeting all the dimensional limitations of claims 1-3, 5 and 25-28, to raise the intensity of edge fields which will, in turn, enhance the sensitivity of the TSM device (paragraphs 0044 and 0046). Furthermore, it would be obvious to one of ordinary skill in the art at the time the invention was made to alter/modify the geometry of the electrode(s) based on the Sauerbrey equation, since it directly relates the change frequency response (Δf) of the TSM device to a change in mass (m) and area (A) of the electrode(s), thus providing one of ordinary skill in the art the basis of specifically designing a TSM device to have

a specific desired output change in frequency based on the change in mass and area of the electrode(s) being employed in measuring or detecting an analyte via mass changes. Lastly, specifically regarding the limitation "continuous" in relation to the surface area of the first electrode, the instant specification fails to disclose that a "continuous" surface area is critical to the instant invention, or solves a particular stated problem, or serves a particular purpose, and as such, it appears from the Applicant's own specification that any type of electrode having a total flat surface area will function equally as well. The Thompson et al. reference clearly discloses that portions of the electrode area are to be removed, thus altering the total surface area to alter/enhance the sensitivity of the TSM device (paragraphs 0044 and 0046). In any event, Thompson et al. further state that the portions of area removed can be located anywhere on the disc area surface of the electrode, and thus, if a portion is taken at the very edge of the circular diameter electrode, the result would meet the general definition of "continuous" surface area, for then the overall surface of the electrode would be uninterrupted. Lastly, since the Applicant has failed to fully define the term/limitation "continuous" in the instant specification regarding the surface area of the electrode, an broad interpretation of the newly added limitation can be construed as any portion of the electrode area having "continuity" or, perhaps, a continuous, uninterrupted line can be drawn (i.e. a diameter) from one point along the circumference to another opposite point, or a continuous, uninterrupted circle can be drawn on the electrode surface (see Fig. 4 below).

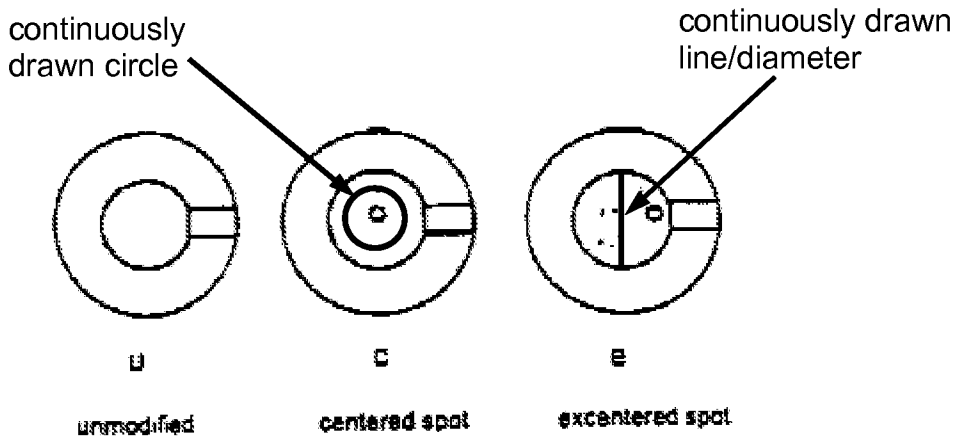

Fig. 4
Thompson et al.

11. Claims 1-5, 8-10 and 25-28 are rejected under 35 U.S.C. § 103(a) as being unpatentable over US 5,852,229 to Josse et al. Josse et al. disclose a thickness shear mode (TSM) piezoelectric resonator and method for use in detecting/measuring an analyte by mass changes (see Josse et al.: col. col. 2, lines 14-25, that it is well known in the art to employ similar devices for detecting and/or sensing, mass detection for very small masses, film thickness monitoring, microbe and similar biological sensing, frequency control, viscosity and density) in a medium (capable of use with any fluid (i.e. liquids and gases) (as recited in claim 24) (see Figs 1a-1c below) having a quartz crystal plate (15) having two flat (as recited in claim 10) crystal surfaces (first and second) wherein the first crystal surface comprises a continuous surface area first

electrode (20) having a surface area smaller than the surface are of a second electrode (30) on the second crystal surface (as recited in claim 4) and wherein the first crystal surface has a first contacting area connected to the first electrode, as well as the second crystal surface and second electrode (as recited in claims 8 and 9). Although Josse et al. does not discloses specific quantitative surface areas of the electrode(s) , that is, specific dimensional/geometrical aspects of the electrode(s) (i.e. surface area < 15 mm^2 or 10 mm^2 or at least 0.05 mm^2 or is 1-5 mm^2 or the distances between the crystal edge and the electrode edge being at least 0.2 mm or 1 mm or 2mm) (as recited in claims 1-3, 5 and 25-28), Josse et al. does carefully teach and explain that 'conductivity of the loading medium results in the expansion of the effective electrode surface area, and that the electroded regions and their electrostatic capacitance is a result of the electrode size, shape and configuration, in other words, the electrode surface area. Josse et al. further teach that the geometries and/or surface areas of the first and second electrodes must differ and that the variations affect the critical frequencies in a predictable way. It is well know in the art that the variations in electrode structure (i.e. total mass and/or area) can increase the sensitivity of the resonator, the ability to sense a variety of materials of interest and the ability to determine concentration of one or more materials of interest. Lastly, the variations in electrode sizes affect the resonant frequencies and anti-resonant frequencies. For example, a TSM having a larger electrode area, and thus larger total mass of electrode, will vibrate differently (i.e. have a different frequency response or resonance frequency characteristics) than that of a TSM having a smaller electrode area and smaller total mass. This is just simple basic physics. These well known variations for quartz type resonators, i.e. changes in geometry (i.e. area and thus edge

distances between the electrode(s) and the quartz plate edge) that lead to changes in frequency response are actually calculable and predictable based on the well known Sauerbrey equation:

$$(\Delta f = -2\Delta m f^2 / A(\mu\rho)^{1/2}$$

Δf: change of frequency of vibration (i.e. response)
f: frequency of basic vibration
Δm: change of mass
A: area of electrode
μ: elastic modulus of torsion of quartz
ρ: density of quartz

12. It should be understood, that the change in mass (Δm) Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to vary the size/surface area/geometry of first electrode to any desired size/area depending on desired analytes (i.e. change in mass (Δm) in the Sauerbrey eqn.) to be measured and desired frequencies of operation, meeting the limitations of claims 1-3, 5 and 25-28).

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US 3,872,411 To Watanabe et al. discloses a quartz resonator having an electrode with an area of less than 0.255 mm^2.

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Fitzgerald whose telephone number is (571) 272-2843. The examiner can normally be reached on Monday-Friday from 7:00 AM to 3:30 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hezron Williams, can be reached on (571) 272-2208. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/John Fitzgerald/
Examiner, Art Unit 2856
10/20/08